CALIFORNIA DIVISION OF MINES AND GEOLOGY
FAULT EVALUATION REPORT FER-179

The San Jacinto Fault Zone (The Claremont, Casa Loma, and Related Faults) in the Lakeview and El Casco Quadrangles, Riverside County, California

by

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June 18, 1987

Minor revisions June 30, 1987
Final Draft July 21, 1987

INTRODUCTION

This fault evaluation report (FER) deals with a portion of the San Jacinto fault zone in the northwestern end of San Jacinto Valley. This valley is basically a partly filled, northwest-southeast trending, graben bounded on the northeast by the Claremont fault and on the southwest by the Casa Loma fault. A statewide program requires the State Geologist to zone faults determined to be sufficiently active (evidence of Holocene displacement) and well-defined (Hart, 1985, p. 5). This program is called the Alquist-Priolo Special Studies Zones Act of 1972 (A-P act) and is described by Hart (1985).

This FER is limited to faults in the Lakeview and El Casco 7.5 minute quadrangles. Faults in the San Jacinto and Hemet 7.5 minute quadrangles, which lie to the southeast, were re-evaluated in 1979 (Hart, 1979) and revised official zone-maps were released January 1, 1980.

Since 1974, when the original zone maps were released, at least nine studies were done by several consulting firms in conformance with the A-P act. Trenching done in conjunction with several of these reports revealed faults which displace Holocene units or soil or both. Many faults were located outside the existing zone boundaries. Preliminary air photo interpretation by Hart as early as 1978 also indicated that some of the traces of the Claremont fault lay outside the zone boundaries (Hart, 1986, personal communication). A letter from the Riverside County Geologist, dated January 31, 1985, requested revision of the El Casco quadrangle Special Studies Zone and prompted this review.

This re-evaluation consists of a review of FER's from adjacent areas, previous mapping, and new studies completed since the original zone maps were issued. Time limitations and the apparent increase in intense cultivation precluded any detailed investigation of fault traces in the field. Selected locations were investigated where access was possible and cultivation or other development has not obscured the faults. Air photos

were reviewed and used in the field to accurately locate and map the fault traces and related geomorphic anomalies. Photo sets used were flown by Fairchild Aerial Surveys (1937, 1939), the U.S. Department of Agriculture (1953) and the U.S. Geological Survey (1967).

SUMMARY OF AVAILABLE DATA

The San Jacinto Valley has been characterized as a "linear graben-like structure" formed between "two right-slip fault strands that overlap to the right in an en echelon pattern" (Sharp, 1975, p. 147-148). This northwest trending valley is bounded on the northeast by the Claremont fault and displaced along the southwest by the Casa Loma fault. In the area studied, they are nearly parallel and lie 0.7 to 2.0 miles apart. The area between the two faults is one of subsidence due to compaction (10 mm/yr), largely due to ground water withdrawal (Lofgren, 1976), and partly due to tectonic downfaulting (3-6 mm/yr) according to Lofgren and Rubin (1975).

Earlier mapping of the faults in San Jacinto Valley (Sharp, 1972; Morton, 1972) was used to delineate Special Studies Zones in 1974 (California Division of Mines and Geology, 1974). Less detailed but more sophisticated mapping of these faults by Sharp (1975, figure 3) and Morton 1977, figure 3) suggest a more complex pattern than shown on their original maps.

Progressive development of ground fissures, possibly related to the lowering of the water table, formed between 1953-1974 (Morton, 1977). He has estimated tectonic subsidence of the graben to be from 3 to 6 mm/yr, compared to non-tectonic subsidence of 3.5 cm/year (maximum). Rasmussen (1981) has reported rupture to the surface on fault traces which he trenched in the San Jacinto quadrangle. He speculates that some of these ruptures may have occurred in 1899 or 1918 (Rasmussen, 1982).

The Casa Loma fault appears to be a normal fault, in the area studied, with little or no evidence of a lateral component (Fett and others, 1967). To the southeast, beyond the area studied, there may be some right-separation (Proctor, 1962). However, right-slip of 2.3 mm/yr is suggested along the Casa Loma fault, based on measurements on a deformed aqueduct pipe during the 1958 to 1973 period (Morton, 1977). The Casa Loma fault lies along the projection of the Clark fault (Sharp, 1975) where evidence for 24 km of right-separation has been established. Sharp (1975) is unsure how this offset may transfer from the Casa Loma fault to the Claremont fault. He speculates (p. 149) about the possible elongation of the San Jacinto Valley, where the faults overlap, a distance comparable to the 24 km offset seen elsewhere.

The Claremont fault seems to show a similar relationship with evidence for right-separation to the northwest (Matti and others, 1985, p. 14). Within the San Jacinto Valley evidence for right-lateral offset decreases (Hart, 1979; Kahle, this report) and a vertical component, down to the southwest becomes more common (Sharp, 1975, Figure 3; Kahle, this report) where the faults overlap. Proctor (1974) reports an overall right-slip of 3.5 cm, measured since 1958, accompanying the subsidence of the valley but does not make it clear whether both faults are involved.

Benchmarks on the original Casa Loma Siphon (location A , Figure 3D) show no difference in elevation, measured between 1939 and 1959, from a point west of the Casa Loma fault to the west portal of the San Jacinto tunnel, located approximately 1,850 feet east of the Casa Loma fault (San Jacinto Quad.) but 200 west of the Claremont fault (Hart, 1979). However, a maximum difference of 2.34 feet was detected between a point west of the Casa Loma fault and a point about 1,000 feet east of the Casa Loma fault (Proctor, 1962, p. 1294).

Trenching and other site investigations, done in compliance with the A-P act, between 1978 and 1984 in the Lakeview and El Casco quadrangles by several consulting firms, has also revealed fault traces which break the soil. The results of these studies are summarized in Table 1 of this report. A number of fault traces were found outside existing zones and unmapped traces were found within the zones. Other trenches did not locate inferred traces within the zones (AP-1151; AP-1237). Locations were plotted on both Figure 2 (maps of existing work) and on Figure 3 (maps of air photo and field observations) for comparison.

One report, by Eberhart and Stone (1984), presented some difficulty in interpreting the geologic map and trench logs. Some faults, identified in trench logs, displace units that are estimated to range from late Pleistocene to early Holocene (Qt - Terrace deposits) or late Pleistocene to middle Holocene ($Qoal_1$ - Older alluvium, upper) in age. The Qt unit, as shown on their map (Eberhart and Stone, 1984, plate 3), is mainly located high on ridge tops or hill slopes much as the lower older alluvial unit ($Qoal_2$) which has an age range from middle to late Pleistocene. Therefore, I do not believe the terrace deposits are Holocene in this area.

Similar reasoning makes me question the age range of the upper (younger) older alluvial unit ($Qoal_1$). This unit is mapped both as an alluvial apron at the foot of the hills and as valley fill, which in some areas is deposited high on the slopes. I have inferred an age range of late Pleistocene for $Qoal_1$ in the hills and valleys northeast of the main trace and an age ranging into the Holocene in areas near the base of the hills where the unit resembles alluvial fans (Eberhart and Stone, 1984). Also no surficial evidence for the faults they show could be seen on air photos.

Morton (1977, figure 3) has shown east facing scarps or scarp-like features northwest of the previously mapped limit of the Casa Loma fault and these are also shown by Sharp (1975, figure 3) in a general way.

FIELD AND AIR PHOTO OBSERVATIONS

The original intent of this re-evaluation was to investigate the Claremont fault in the El Casco quadrangle. It soon became obvious that some of the traces on the Lakeview quadrangle were not accurately mapped and that others had been missed. This led, in turn, to a review of the Casa Loma fault and the same situation was noted there. Air photo interpretation verified those possible scarps shown by Morton (1977) and by Sharp (1975) on the northwestern end of the Casa Loma fault. Other differences were noted on the Claremont fault. Selected areas were

investigated in the field and, though the evidence in some areas has been obliterated by intense cultivation, enough was seen to verify the air photo interpretation.

Claremont Fault

Portions of the Claremont fault correspond to traces previously mapped (Sharp, 1972; Morton, 1972). A careful review of the air photos, spurred by insight suggested by some of the trenching (Table 1, AP-1251, AP-1300, AP-1720), led to more detail than previously shown and revealed a number of branches and traces not mapped before. The air photo interpretations and field observation are shown on Figures 3a to 3d and the trench locations are included for verification. Traces visible only in trenches are also added and color coded to distinguish them from air photo traces.

Newly recognized west-facing scarps were found east of the previously mapped Claremont fault. Faults exposed in trenches along the base of the hills southeast of Jackrabbit Trail (Table 1, AP-1720) closely matched anomalous features seen on the air photos. The base of these slopes, particulary at ridge noses, are different than similar slopes elsewhere in the area. They are slightly to moderately oversteepened near the base of the hills. This oversteepening is subtle but consistent. These ridge noses resemble mini-faceted-ridges, some branching of faults is common, and the fault trend is sinuous, resembling a normal fault scarp displaced down to the southwest. Locally the drainage channels seem deeply incised on the "upthrown" part of the scarp and form broad, small alluvial fans on the "downthrown" side. Similar scarps are present both southeast and northwest of the area trenched. When interpreted as fault scarps they fit a pattern seen for subsidiary vertical faults commonly associated with movement on large lateral-displacement faults. These scarps merge with the more linear scarps present approximately 1.5 miles northwest and 2.0 miles southeast of Jackrabbit Trail (Location G , Figure 3b). Similar slopes farther northwest, eroded in the same material, show a more normal (i.e., non-faulted) aspect, merging smoothly with the alluvial apron.

Locally the main trace of the Claremont fault is sinuous or branching and graben or horst structures are present (see Figure 3b, Location J and Figure 3c, Locations B and C). Some areas of "reversal of face" are also present along linear portions of the fault, as at Location D (Figure 3c) indicating a strong lateral component of displacement. In general the Claremont fault is marked by a prominent to moderate southwest-facing scarp.

Casa Loma Fault

The Casa Loma fault is marked by a prominent, 10-15 foot high, northeast-facing, sinuous scarp trending N30-50°W along the southwest side of San Jacinto Valley. Most of the Casa Loma fault is shown with fair accuracy on previous zone maps (CDMG, 1974), but considerable difference in detail was noted. Multi-stepped features are present near the San Jacinto Reservoir (Lakeview quadrangle, Figure 3d). Left-stepping, en echelon traces occur locally (Locations E and F , Figure 3c) and the scarps seen on air photos are generally more sinuous, have more branches and multiple traces than shown previously.

The Casa Loma fault has been extended into the El Casco quadrangle along some discontinuous, less prominent (lower) scarps visible on air photos. Both Morton (1977) and Sharp (1975) show scarps extending into the El Casco quadrangle. These were partly visible on the air photos I had. Other scarps were also seen about 4,000 feet west of the ones they show near the northwest end of the fault.

There are also some previously unmapped, subtle, east-facing scarps west of the main fault south of Casa Loma Hill on the Lakeview quadrangle (Figure 3d). These are not continuous but they are clear on air photos and can be followed far enough to suggest that they represent significant secondary faulting. They lie from 2,000 to 4,000 feet west of the main fault and the offset, down to the northeast, is probably less than a few feet but the scarps appear fairly fresh. Such a pattern is not uncommon for graben-bounding structures and may be analagous to the normal faulting east of the main Claremont fault.

Fissures are visible on all the sets of air photos used but are most prominent on the U.S. Geological Survey (1967) photos. These fissures (shown as cracks on Figures 3b and 3c) are included here because they may be a source of foundation problems not directly attributable to fault rupture. They appear to be related to groundwater withdrawal and have a history of progressive development (Morton, 1977). No very recent air photos were available to show the most recent pattern of fissures. Those visible on the 1967 photos (U.S.G.S., 1967) are included as a representative sample of those fissures present in 1967.

Two other areas have short, northwest-facing scarps, transverse to well-developed alluvial fans, which offset the fan surfaces. One set, south of location B (Figure 3c) seems to truncate traces of the main fault. The other, at location I (Figure 3b) is in an area which may be influenced by the proximity of the Claremont and Casa Loma faults to each other. Other similar features are present in the valley but appear to be man-made drainage ditches or contour channels dug to reduce runoff. Those mapped as scarps are, however, more sinuous and do not follow the contours as faithfully as the man-made features.

CONCLUSIONS

The Claremont fault, as mapped for this report, is well-defined throughout most of its length by scarps and other geomorphic features in Holocene alluvium. This differs from previous mapping which essentially connects the two prominent scarps by a projected buried trace (Figures 2a and 2c). As mapped here the fault is more continuous but less linear. The area between the linear scarps at D (Figure 3c) and J (Figure 3b) is one where the fault changes character to a sinuous trace with a significant normal component. Because this segment is well-defined it was not deemed necessary to retain the buried segment as previously mapped (Sharp, 1972; Morton, 1972). The evidence for "sufficient activity," gained from the trenches is enough to warrant revising the faults and their related zone boundaries.

The inferred faults mapped by Eberhart and Stone (1984), in the hilly parts of the areas they studied, lack traceability and, by implication activity. This suggests, as discussed in the summary of available data, that the Qt unit and parts of the $Qoal_1$ unit are not Holocene in age. They also call one fault zone in the hills the Claremont fault rather then the scarp-distinguished fault near Gilman Springs Road. Sharp (1972, 1975) has clearly labeled the main trace in this area the Claremont fault and this convention is followed here.

The Casa Loma fault is well-defined by linear and sinuous scarps in Holocene deposits throughout much of its length and except for detail is not essentially different than mapped previously. However, subparallel subsidiary faults were seen on air photos and the main fault was extended to the northwest. These extensions are not as well-defined as the main fault but appear to be related. They are likely to be as active as the main fault although the slip per episode may be less.

RECOMMENDATIONS

Claremont Fault. Revised zoning is recommended for both the El Casco (Figure 4) and Lakeview (Figure 5) quadrangles. References cited are identified on those maps.

Casa Loma Fault. Revised zoning is recommended for the Lakeview quadrangle (Figure 5) to limit the width of the zone because of the increased accuracy of mapping. Also limited, unconnected zones are recommended for the scarps found west of the main fault. The Casa Loma fault should be extended into the El Casco quadrangle and zoned as shown on Figure 4. References to be cited are identified on Figures 4 and 5.

Other isolated scarps and subsidiary faults should be zoned as shown on Figures 4 and 5. Areas where fissures, due to groundwater withdrawal, are present should be shown as indicated.

Reviewed and recommendations approved.
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9/23/87

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June 18, 1987
Revised June 30, 1987
Final Draft July 21, 1987

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Table 1. Tabulation of data from trench logs on file with the California Division of Mines and Geology. Trenches dug in compliance with the Alquist-Priolo Special Studies Zones Act of 1972.

CDMG File #	Firm Doing Investigation	Date of Report	Site Description and Location	Was Trenching Done?	Trench #	Trench Length	Fault Description: Feet	From	Strike N-	Dip	Apparent Displacement: Vert.	Down Side	Lateral Evidence?	Is Unit Offset?: Soil	Holocene	Pleist.	Older	Comments
AP-778	Lewis S. Lohr (1978)	6/3/78	E. of Warren Rd., S. of Mead Rd. – NE of San Jacinto. NW¼ Sec 19, T4S, R1W. (Lakeview Quad.)	yes	1	343'	72-85	E end	10-20W	65-85E	~2.0'	E		No	Yes	–	–	Zone of 4 older (72-80') and 5 younger faults (80-85')
							137-178		?	–	~2.0'	E		No	Yes	–	–	Zone of older faults; one younger (163').
							220-240		?		9.5'	E		Yes?	Yes	–	+	Zone of 5 faults; most westerly, youngest (224'
					2	860'								–	No	–	–	No faults found.
AP-945	Lewis S. Lohr (1979)	2/10/79	NE of Gilman Springs Rd. SE¼ Sec 26, T3S, R2W. (El Casco Quad.)	No														Map shows faults essentially as on Fig. 3b
AP-1151	Lewis S. Lohr (1980a)	4/est/80	SW of Gilman Springs Rd. NE¼ Sec. 26, T3S, R2W. (El Casco Quad.)	yes	1	1500'								No	No	–	–	No faults and few fractures found.
AP-1237	Pioneer Consultants (1980)	4/10/80	SW of Gilman Springs Rd. NE¼ Sec 8, T4S, R1W. (Lakeview Quad.) and NW¼ Sec 9, T4S, R1W. (San Jacinto Quad.)	yes	1	490'	46-62	NE end	75-80W	715-81N	~2.5'	NE	yes	–	Yes	–	–	Zone of 3 faults with reversals of vertical offset. On San Jacinto Quad.
					2	800'								No	No	–	–	No faults found. Slight downwarps (Dom E) at 100' and 500' from SW end.
					3	112'								No	No	–	–	No faults found. Bottom of SW facing slope at 62'. On San Jacinto Quad.
AP-1251	Lewis S. Lohr (1980b)	9/24/80	SW of Gilman Springs Rd. Center Sec 36, T3S, R2W. (Lakeview Quad.)	yes	1	1600'	85-100	NE end	45-48W	90	5.5'	SW		Yes?	Yes	–	–	Fault at 93' extends nearly to surface. All faults penetrate youngest layer.
							142-146		?	90	?	? SW	Yes?	No	Yes	–	–	Offset obscure – may indicate lateral offset.
							227-228		46W	90	0.8'	SW		No	Yes	–	–	Units SW of fault warped, Dom SW.
					2	283'	44	NE end	47W	?70S	0.7'	SW		No	Yes	–	–	Breaks youngest layer.
							61-63		68W	?70S	?	SW		No	Yes	–	–	
							68		?	90	?	SW		No	Yes	–	–	3 faults don't break youngest layer.
							78		?	90?	?	NE		No	Yes	–	–	Breaks youngest layer.
							88		?	90?	?	?		No	Yes	–	–	2 faults, don't break youngest layer.
							105-129		46W	90	1.3'	SW		No	Yes	–	–	4 older faults.
							145-149		45-47W	90-80S	?	SW		No	Yes	–	–	Breaks youngest layer.
							210-216						Yes?	No	Yes?	–	–	No structure observed.
AP-1300	Lewis S. Lohr (1980c).	12/16/80	SW of Gilman Springs Rd. S of Alessandro Blvd. NE¼ Sec 17 and SW¼ Sec 16 T3S, R2W. (El Casco Quad.)	Yes	1	1582'	310	NE end	40W	35-58N		NE	yes	Yes?	Yes	–	–	Inferred to surface; Mismatch.
							350		45W	90-80S	1.8-22'	NE		Yes	Yes	–	–	Extends to surface.
							675-710		47-57W	90-70S	?>10.0'	SW	yes	Yes?	Yes	–	–	Zone of 12 faults; youngest at 685'; Mismatch.
					2	126'	35	NE end	55W	85N	1.0'	SW	Yes?	No	Yes	–	–	Mismatch.
							63-68		32W	80-85N	3.0"	SW		No	Yes	–	–	3 close faults, each with same units offset.
							100		42W		0.4'	NE	Yes?	No?	Yes	–	–	Mismatch.

Table 1. Tabulation of data from trench logs on file with the California Division of Mines and Geology. Trenches dug in compliance with the Alquist-Priolo Special Studies Zones Act of 1972.

CDMG File #	Firm Doing Investigation	Date of Report	Site Description and Location	Was Trenching Done?	Trench #	Trench Length	Fault Description: Feet	Fault Description: From	Fault Description: Strike N–	Fault Description: Dip	Apparent Displacement: Vert.	Apparent Displacement: Down Side	Apparent Displacement: Lateral Evidence?	Is Unit Offset?: Soil	Is Unit Offset?: Holocene	Is Unit Offset?: Pleist.	Is Unit Offset?: Older	Comments
AP-1300 (Cont.)	Lahr (1980c)			yes	3	126'	20	NE end	42W	66N	1.2'	NE	No	No	Yes	–	–	Good match; 2 close faults.
					4	134'	80	SW end	37W	79-83S	0.8-1.4'	NE	No?	No	Yes	–	–	Fair match.
					5	37'	15-18	SW end	42W	85N	1.65-1.75'	NE	No?	No	Yes	–	–	Fair match.
					6	118'	55	SW end	45W	90-85S	?0.5'	NE	Yes?	No	Yes	–	–	Mismatch.
					7	120'	30	SW end	42W	90-85N	?	SW	No	No	Yes	–	–	3 close faults; good match; breaks older layers.
							50		37W	50N	?	SW	No	No	Yes	–	–	2 close faults; good match.
							60		58W	65N	?	SW	Yes?	Yes?	Yes	–	–	2 close faults; mismatch.
							70			N'ly	?	NE		No	Yes	–	–	Poor match. Breaks only older layers.
							75		52W	60N	?	NE	Yes?	Yes?	Yes	–	–	Breaks to surface; mismatch.
							103		55W	90	?	? NE	Yes?	Yes?	Yes	–	–	2 close faults; mismatch.
					8	110'	40-45	SW end	45-50W	90-80S	1.1'	SW		No	Yes	–	–	4 close faults; fair match.
							52-55		38-40W	90	1.1?	SW	Yes	No	Yes	–	–	3 close faults; fair match.
							70		48W	90-80S	0.5'	SW		Yes?	Yes	–	–	Breaks to surface; good match.
					9	271'	43-68	SW end	45-50W	42-80N	3.0'	NE		No	Yes	–	–	Series of 10 faults; stepped down; good match.
							60		45W	50N	1.0'	NE		Yes?	Yes	–	–	Breaks to surface; others older.
							70-78		40-45W	50-80N	?	U+D	Yes?	No	Yes	–	–	3 close faults; good match; reversals.
							87		43W	85N	0.8'	NE		No	Yes	–	–	Doesn't break to surface; fair match.
							100		?	90±10	?	?	Yes?	Yes?	Yes	–	–	Breaks near surface; mismatch.
					10	160'	64	SW end	?	60-70S	?	? SW	Yes?	No	Yes	–	–	Breaks near surface; poor match.
							80		?	90-75N	?	NE		No	Yes	–	–	6 older faults; good match.
							100		45W	90-85S	?2.0'	NE	Yes?	Yes?	Yes	–	–	Breaks to surface; mismatch.
							100-108		45W	85N	~1.0+	NE		No	Yes	–	–	Breaks older layers; good match.
					11	88'	25	SW end	40W	65-70N	1.0-1.5'	NE	Yes?	Yes?	Yes	–	–	Breaks near surface; fair match.
							40		42W	70N	0.8'	NE		No	Yes	–	–	Breaks older layers; good match; 2 close faults.
							45		?	70N	?	?	Yes?	No	Yes	–	–	Poor match.
					12	120'	25	SW end	40W	90	0.5'	NE	Yes?	No?	Yes	–	–	Good match but may be lateral movement.
							30		?	90-85N	?2.5'	? NE	Yes?	No?	Yes	–	–	Poor match; may break to soil.
							35		?	60N	?	NE	No	No	Yes	–	–	Good match.
							40+42		30W	90+85S	?	Between		No	Yes	–	–	Poor match; graben.
							55		?	90		SW	Yes?	No	Yes	–	–	Poor match; upper layers match; lower don't
					13	282'	20-40	SW end	30-35W	80-85N	1.1'?	NE	No?	No	Yes	–	–	Good match; 6 faults stepped Dan NE.
							160-174		40W	90-85S	1.3?	SW	No?	No	Yes	–	–	Good match; 4 faults stepped Dan SW.
					14	124'	75	NE end	?	90-85N	?	? SW	No	No?	Yes	–	–	Good match.
							85-98		?	90	?	? SW		No	Yes	–	–	Good match; 6 faults, small steps Dan SW.

Table 1. Tabulation of data from trench logs on file with the California Division of Mines and Geology. Trenches dug in compliance with the Alquist-Priolo Special Studies Zones Act of 1972.

CDMG File #	Firm Doing Investigation	Date of Report	Site Description and Location	Was Trenching Done?	Trench #	Trench Length	Fault Description: Feet	From	Strike N–	Dip	Apparent Displacement: Vert.	Down Side	Lateral Evidence	Is Unit Offset? Soil	Holocene	Pleist.	Older	Comments
AP-1300	Lohr (1980c)				15	100'	28	NE end	40W	90	0.4'	SW	No	No	Yes	–	–	Good match.
							50		60W	85S	0.2'	SW	No	No	Yes	–	–	Good match.
							60		47W	85N	0.1'	SW	No	No	Yes	–	–	Good match.
							68-75		?	90-70N	?	? SW	Yes?	No	Yes	–	–	3 branching faults; fair match; Reversals. Units thicker SW.
					16	107'	45-49	NE end	?	80N	1.4'	NE	Yes	No?	Yes	–	–	4 faults; mismatch.
							52-55		?	90-80N	?	NE	Yes	No?	Yes	–	–	5 close faults; mismatch.
							60		20W	80N	1.8'	NE	Yes?	Yes?	Yes	–	–	Main fault; mismatch.
					17	95'	45-53		30W	70S-70N	1.8'	NE	No	No	Yes	–	–	2 converging faults; others between; good match
							55-60		27W	70N	3-3.2'	NE	Yes?	No	Yes	–	–	3 close faults; poor match.
							62-69		?	90-80N	>1.0'	NE	No	No	Yes	–	–	5 close faults; good match.
AP-1300 Addendum 1	Lohr (1980d)	3/30/81	Same; More accurate map of trench locations.		6a	120'								No	No	–	–	No faults found; good layering.
					13a	73'								No	No	–	–	No faults found; good layering.
					13b	106'								No	No	–	–	No faults found; good layering.
AP-1720	Eberhart & Stone, Inc. (1984)	9/30/84	NE of Gilman Springs Rd. E of Jackrabbit Trail S½ Sec 23, N½ Sec 26 T3S, R2W. (El Casco Quad)	Yes	1	690'	134	N end	70W	65N				No	–	–	Yes	Separates Tertiary rocks only.
							196		10W	90				No	–	–	Yes	" " " "
							315		30E	90				No	–	Yes	Yes?	Fault to older Qal; channel deposit?.
							350-380		50E	90				No	–	–	Yes	Shear zone in Tertiary rocks only.
							505		65W	60S				No	–	–	Yes	Fault in Tertiary rocks only.
							593-595		70W	60-80S				No	–	–	Yes	Shear zone in Tertiary rocks only.
							607-610		80W	90				No	–	–	Yes	" " " " " "
							620-625		65E	90?				No	–	–	Yes	" " " " " "
					1A	152'	97	NE end	35E	75S				No	–	–	Yes	Shear zone in Tertiary rocks.
							105		30-40W	90				No	–	–	Yes	" " " " "
					1B	88'	25-34	NE end	25W	75N			Yes?	No		Yes?	Yes	2 faults with Qt wedge separates Tertiary rocks.
					1C	215	170	NE end	35W	90		S	?	No	–?	Yes	Yes	Fault separates Qt and Tertiary rocks.
							205		50W	75N		S	No	No	–?	Yes	Yes	" " " " " "
					1D	463'	20	NE end	25W	83N	1.5'	S	?	Yes	–	–	Yes	Breaks soil on Tertiary rocks.
							132		20W	90	>1.0'	N	Yes	Yes	–	–	Yes	} Irregular soil-Tert. contact suggests
							138		55W	55N	?	?	Yes	Yes	–	–	Yes	} these may be due to lateral movement.
							195		55W	90	?	S	Yes	Yes	–?	Yes	Yes	} Wedge of Qt between with Qt over Tert. rocks
							200		43W	70S		S	Yes?	Yes	–?	Yes	Yes	} to S. Base of soil steps down to S.
							250		35-60W	90-80S	1.5'	S	Yes?	Yes	–?	Yes?	Yes	2 close faults, unlabelled units, Qt or Tert?
							272		45W	75S	0.5'	S	Yes	Yes	–	–	Yes	? Tert. rocks sheared 12' N and 5' S of fault.
							306		50W	85S	0.5'	S		Yes	–	–	Yes	Soil offset – on Tertiary rocks.
							312		60W	80S				Yes	–	–	Yes	Soil faulted; sits on Tertiary rocks.
							331		55W	90	0.5'	N		Yes	–	–	Yes	" " " " " "
							361		57W	85S	0.7'	S		Yes	–?	Yes	Yes	Tert. rocks N. – Qt on Tert. S.; soil faulted.
					1E	30'	25	NE end	25W	90				?	–?	Yes	Yes	Qt on Tert. both sides; may extend into soil.

Table 1. Tabulation of data from trench logs on file with the California Division of Mines and Geology. Trenches dug in compliance with the Alquist-Priolo Special Studies Zones Act of 1972.

CDMG File #	Firm Doing Investigation	Date of Report	Site Description and Location	Was Trenching Done?	Trench #	Trench Length	Fault Description: Feet	From	Strike N–	Dip	Apparent Displacement: Vert.	Down Side	Lateral Evidence?	Is Unit Offset? Soil	Holocene	Pleist.	Older	Comments
AP-1720 (Cont.)					2	354'	63	NE end	25W	85N				No	—	—	Yes	Separates Tertiary rocks.
							84		90W	70N				No	—	—	Yes	" " " "
							320		35-50W	60N				No	—?	Yes	Yes	Separates younger Qoal, from Tertiary rock (Qoal, said to be Holocene & Pleist. – don't agree
					2A	160'		NE end										No faults found.
					3	464'	185	NE end	45W	70N				No	–?	Yes	Yes	Separates Qoal, (? Holocene; see text).
					4	1178'	85	NE end	45W	60N				No	—	—	Yes	Separates Tertiary rocks.
							345		NS	70E				No	—	—	Yes	" " " "
							380		25W	70N				No	—	—	Yes	" " " "
							391		30W	90				No?	—	—	Yes	" " " "; ? wedge of soils.
							405		40W	85N				No	—	—	Yes	Older Qoal? in channel? above fault.
							775		65W	90				No	No?	Yes	—	Breaks undivided older alluvium.
							873		55W	90				Yes	Yes?	Yes	—	" " " " and soil.
							883		25W	90				Yes	Yes?	Yes	—	" " " " " "
							890		10W	90				yes	Yes?	Yes	—	" " " " " "
							920		20W	80N				Yes	Yes?	Yes	—	" " " " " "
							995		30W	90				Yes	Yes?	Yes	—	" " " " " "
							1052		25W	80S				Yes	Yes?	Yes	—	" " " " " "
							1060		20-30W	90				Yes	Yes	Yes	—	Separates Qoal and Qal.
					5	650'	14	NE end	45W	90				Yes	—	—	Yes	Break soil and Tertiary rocks.
							14-46							No	—	—	Yes	Shear zone in Tertiary rocks.
							96		40W	90				Yes	yes?	Yes	—	Extends into soil from colluvium.
							140		45W	90				Yes	yes?	Yes	—	½" crack at surface.
							148		40W	90				Yes	Yes?	Yes	—	Breaks soil and undivided Qoal.
							222		55-60W	90				No	No?	Yes	—	Does not break soil or Qal.
							285		30-40W	90				—	Yes?	Yes	—	Breaks only undivided Qoal.
					5A	262'	182	NE end	43W	90				No	No?	No?	Yes?	Only shown near bottom of trench.
							233		65W	60-70S				Yes?	Yes?	Yes	Yes	Tertiary rocks (N) against Qoal (S).
					6	220'	80-118	NE end	50W	90				No	No	No	Yes	Shear zone in Tertiary rocks.
					6A	74'	27	NE end	45W	70N				—	—	—	Yes	Tertiary rocks only
					7	467'		E end						No	–?	No	No	No faults found
					8	563'	225-232	NE end	50-55W	90-70N				No	No	No	Yes	Topsoil covered by fill in channel or trough? with fault at bottom.
							348		55W	90				—	—	—	Yes	Only Tertiary rocks present.
							382		40W	75S				—	—	—	Yes	" " " "
							395		35-40W	90				—	—	—	Yes	" " " "

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CDMG File #	Firm Doing Investigation	Date of Report	Site Description and Location	Was Trenching Done?	Trench #	Trench Length	Fault Description: Feet	From	Strike N–	Dip	Apparent Displacement: Vert.	Down Side	Lateral Evidence?	Is Unit Offset?: Soil	Holocene	Pleist.	Older	Comments
AP-1720 (Cont.)					9	470'	10	NE end	70W	90				No	Yes?	Yes	–	Fault in Qoal?; maybe mislabled; Holocene?
							30		70W	85N				No	Yes?	Yes	–	" " " " " "
				▶			78		40W	90				Yes?	Yes?	Yes	–	Dashed through soil; solid in Qoal.
							125		25W	90				Yes	Yes?	Yes	–	Well-developed 1" crack at surface. N20–30W.
							263		30–50W	90				Yes?	Yes?	Yes	–	Dashed and queried in soil.
					10	732'	190	NE end	60W	83S	0.3'	NE	Yes?	Yes?	Yes?	Yes	–	Dashed and queried in soil.
							220		50–60W	90				Yes?	Yes?	Yes	–	Fault zone about 13' wide. Dashed and queried in soil.
					11	405'	3	NE end	55W	65S				Yes	–	–	Yes	Soil apparently against fault to S.
							15		65W	75S				No	–	–	Yes	Tertiary rocks only faulted.
							44		60W	70S				No	–	–	Yes	" " " "
							52		50W	90				No?	–	–	Yes	Soil falls trough above fault in Tert. rocks.
				▶			320		40–50W	90				Yes	Yes?	Yes	–	Crack at surface.
				▶			350		40–50W	90				No	Yes	Yes	–	Separates Qoal (N) from Qal (S).
					12	98'								–	–?	No	No	No faults found.
					13	92'	20–38	NE end	50W	90				No	–	–	Yes	Wide weathered shear zone.
					14	339'								No	–	No	–	No faults found
					14A	60	10	N end	70W	70N				–	–?	No	Yes	Fault in Tert. rocks; log unclear, could separate Tert. from Qoal.
					15	192'								–	–?	No	No	No faults found
					16	175'	69	N end	80E	90				–	–	–	Yes	Fault in Tertiary rocks only.
					17	115'								–	–?	No	No	No faults found.
					18	190'	148	N end	25–30W	70S			Yes?	–	–	–	Yes	All in Tertiary rocks; mismatch suggests some lateral movement.
							154		35W	88S			Yes?	–	–	–	Yes	
							162		NS	70E			Yes?	–	–	–	Yes	
							167		30W	90			Yes?	–	–	–	Yes	
					19	100'	17	NE end	50W	70S		NE?		No	–	–	Yes	
							68		40W			SW?		Yes?	–	–	Yes	Wedge of soil S. on Tert. Tertiary to NE. Queried through soil.
AP-1756	Pioneer Consultants (1979)	10/1/79	N. of Gilman Springs Rd. W of Jackrabbit Trail. Sec 22 and S½ Sec 15 T3S, R2W. (El Casco Quad)	yes	1	40'								No	No	–	–	No faults found. (Trench not plotted.)
					2	90'	66–68	NE end	53W	82S			Yes?	Yes?	–	–	Yes	Fault in Tert. rocks. (Trench not plotted.)

Table 1. Tabulation of data from trench logs on file with the California Division of Mines and Geology. Trenches dug in compliance with the Alquist-Priolo Special Studies Zones Act of 1972.

CDMG File #	Firm Doing Investigation	Date of Report	Site Description and Location	Was Trenching Done?	Trench #	Trench Length	Fault Description: Feet	From	Strike N–	Dip	Apparent Displacement: Vert.	Down Side	Lateral Evidence	Is Unit Offset?: Soil	Holocene	Pleist.	Older	Comments
AP-1756 (Cont.)					3	20'	10	SW end	45-50W	69S				No	—	—	Yes	Fault in Tertiary rocks.
					4	20'	10	SW end	50W	70N				No	—	—	Yes	" " " " "
					▶ 5	100'	76	SW end	45W	82S				Yes?	Yes?	Yes	—	Followed faintly to surface.
							88		45W	82S				Yes?	Yes?	Yes	—	" " " " "
					▶ 5A	370'	30-34	SW end	46W	85S				Yes	—	—	Yes	Vertical cracks in soil mantle.
							56			75S			?	Yes?	—	—	Yes	
							65				1.0'	NE	?	Yes	—	—	Yes	Extends to surface.
					6	60'								No	No	—	—	No faults Found. (Trench not plotted.)
					7	90'								No	—	—	No	" " " " " "
					8	200'								No	No	—	—	" " " " " "
					8A	120'								—	No	No	—	" " " " " "
					9	Not shown on map and no log included.												
					10	80'								No	No	No	—	No faults Found. Numerous caliche filled cracks. (Trench not plotted).
					10	90'	Trench offset 50' East of first #10.											Same.
					11	25'	6	SW end	45W	59S	2.0'	NE	?	Yes	—	Yes	—	Through soil to surface.
							17-18		46W	85N	?2.0'	SW	Yes	Yes	—	Yes	—	" " " " "
					12	Not shown on map and no log included.												
					13	"	"	"	"	"	"	"	"					
					14	"	"	"	"	"	"	"	"					
					15	215'								—	No	No	NO	No Faults found. (Trench not plotted)

Notes:

— Indicates unit not present.

—? Indicates unit not believed to be this age at this location.

▶ Indicates location in trench which corresponds with trace visible on air photos.

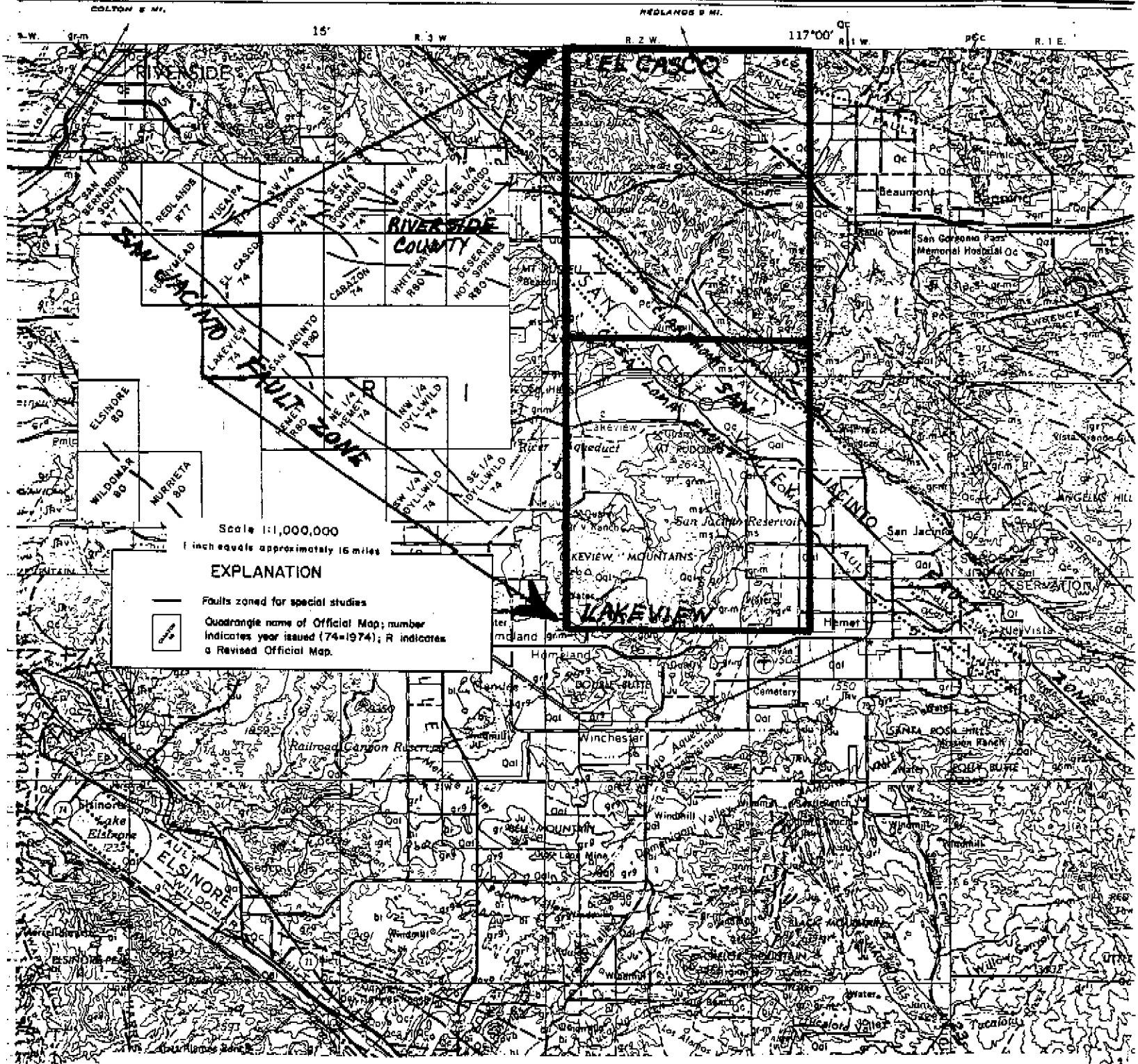

Figure 1. (FER-179). Index map showing location of Special Studies Zones Maps, Lakeview and El Casco Quadrangles, and their relationship to the San Jacinto Fault Zone. Modified after Hart (1985) and Rogers (1965).

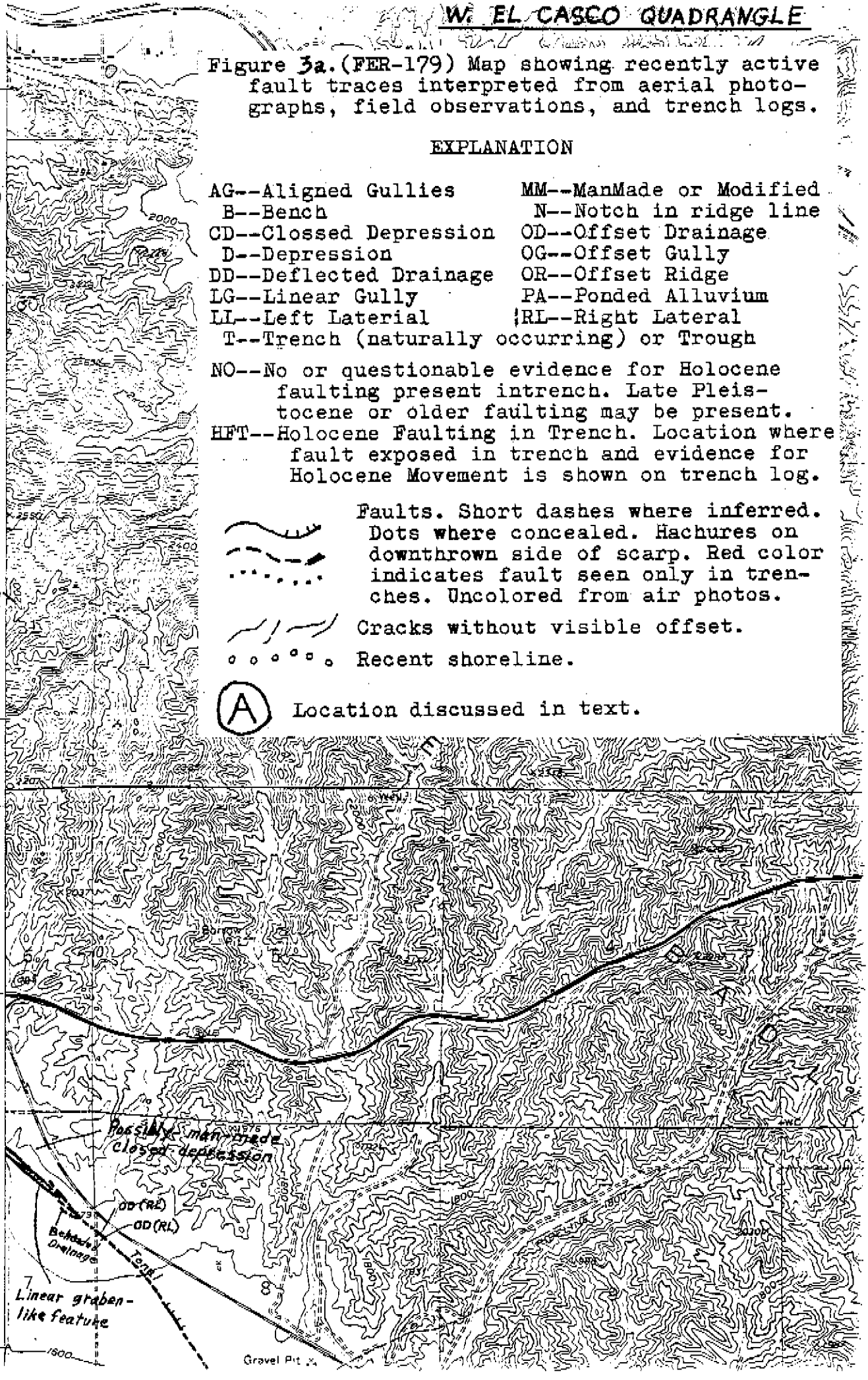

Figure 3a. (FER-179) Map showing recently active fault traces interpreted from aerial photographs, field observations, and trench logs.

EXPLANATION

AG--Aligned Gullies
B--Bench
CD--Closed Depression
D--Depression
DD--Deflected Drainage
LG--Linear Gully
LL--Left Lateral
MM--ManMade or Modified
N--Notch in ridge line
OD--Offset Drainage
OG--Offset Gully
OR--Offset Ridge
PA--Ponded Alluvium
RL--Right Lateral
T--Trench (naturally occurring) or Trough

NO--No or questionable evidence for Holocene faulting present intrench. Late Pleistocene or older faulting may be present.

HFT--Holocene Faulting in Trench. Location where fault exposed in trench and evidence for Holocene Movement is shown on trench log.

Faults. Short dashes where inferred. Dots where concealed. Hachures on downthrown side of scarp. Red color indicates fault seen only in trenches. Uncolored from air photos.

Cracks without visible offset.

Recent shoreline.

(A) Location discussed in text.

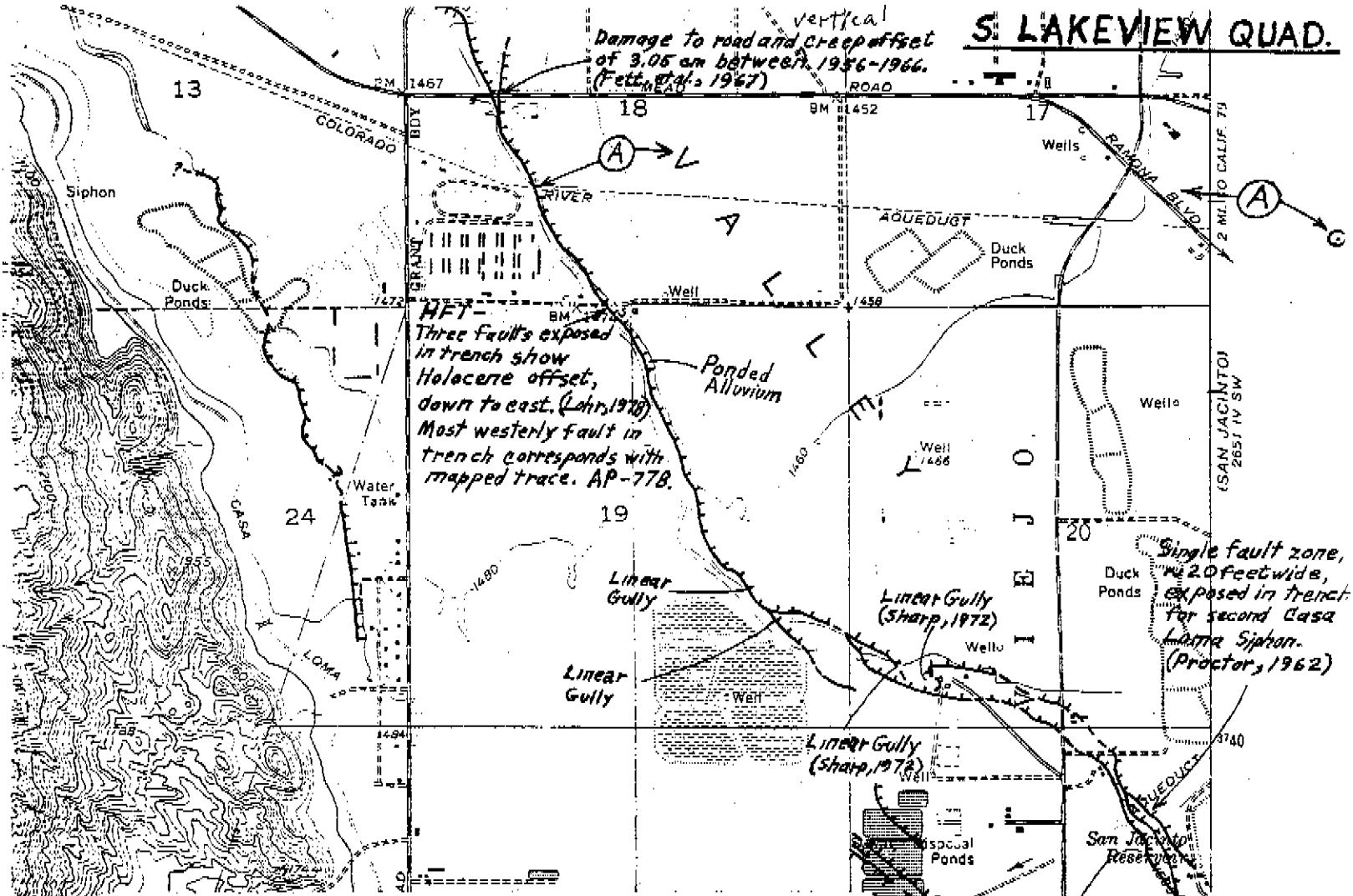

Figure 3d. (FER-179) Map showing recently active fault traces interpreted from aerial photographs, field observations, and trench logs.

EXPLANATION

AG--Aligned Gullies
B--Bench
CD--Clossed Depression
D--Depression
DD--Deflected Drainage
LG--Linear Gully
LL--Left Lateral
MM--ManMade or Modified
N--Notch in ridge line
OD--Offset Drainage
OG--Offset Gully
OR--Offset Ridge
PA--Ponded Alluvium
RL--Right Lateral
T--Trench (naturally occurring) or Trough

NO--No or questionable evidence for Holocene faulting present intrench. Late Pleistocene or older faulting may be present.

HFT--Holocene Faulting in Trench. Location where fault exposed in trench and evidence for Holocene Movement is shown on trench log.

Faults. Short dashes where inferred. Dots where concealed. Hachures on downthrown side of scarp. Red color indicates fault seen only in trenches. Uncolored from air photos.

Cracks without visible offset.

Recent shoreline.

(A) Location discussed in text.